Test Your Understanding 1

A process that produces audiotapes is monitored for the thickness of magnetic coating on the tapes. In Figure 1, the thicknesses of 150 thickness measurements (in microns) are plotted versus the order in which they were taken. Your boss asks you how the process is performing. What do you say?

![Graph showing the thickness of magnetic coating over 150 orders](image)

Figure 1: One-hundred fifty consecutive measurements of the thickness of magnetic coating on audio tape
Test Your Understanding 2

Figure 2 shows a time series plot. What is the simplest moving average that will remove the cycles in the plot? Apply the moving average to the first 5 data values: $-0.95, 0.79, -0.99, 1.20, -1.03$. Plot the moving average values on the graph to demonstrate the cycles have been removed.

Figure 2: Time series plot
Test Your Understanding 3

A microhardness tester is a machine designed to test the hardness of material. In order to test the repeatability and reproducibility of the measuring process using a particular microhardness tester, four operators each took 20 measurements of the hardness of the same metal piece. Time series plots showed that the measuring process was stationary for each of them. Summarize what the stratified plot in Figure 3 tells about the R&R of the measuring process.

Figure 3: Force measurements from a microhardness tester
Test Your Understanding 4

Figure 3 shows four frequency histograms.

![Histograms of Frequency Distributions](image)

Figure 4: *Four frequency histograms*

Briefly describe the main features of each histogram.
Test Your Understanding 5

Figure 3 shows four frequency histograms.

For each histogram, describe the summary measures you would use to back up your description.
Test Your Understanding 6

The lengths of seven telephone calls, in minutes, are 17, 7, 1, 4, 39, 2, 11. Generate a boxplot for these data. Does the boxplot identify any outliers?
Test Your Understanding 7

Compute a 1-time trimmed mean and a 1-time Winsorized mean for the data from the last TYU: 17, 7, 1, 4, 39, 2, 11
Test Your Understanding 8

Suppose you want to estimate the average amount spent by first term sophomores at WPI for textbooks, and that you can interview 10 students for your study.

(a) If you believe the distribution of the amounts spent for textbooks is pretty consistent across all students, how might you choose the 10 students? Why?

(b) If you believe that textbook expenses for engineering students are substantially higher than for other majors, how might you choose the 10 students? Why?

(c) If you want to be certain to obtain an estimate for humanities majors, as well as other majors, how might you choose the 10 students? Why?
Test Your Understanding 9

To compare the efficacy of mosquito repellent, volunteers have an arm coated with a prescribed amount of the product. The arm is then inserted into a chamber filled with mosquitoes for a fixed amount of time and the number of bites counted (YUCK!). To compare the efficacies of two different repellants, volunteers are randomly divided into two groups. One group is given repellant 1 and the other repellant 2 and the test described above is conducted for each.

1. Is this a controlled experiment? Why?

2. If it is a controlled experiment, describe the

   (a) Experimental units

   (b) Response

   (c) Experimental factor(s)

   (d) Possible nuisance factors

   (e) Factor levels

   (f) Treatments

   (g) Effect
Test Your Understanding 10

Recall the experiment described in TYU 9:

To compare the efficacy of mosquito repellant, volunteers have an arm coated with a prescribed amount of the product. The arm is then inserted into a chamber filled with mosquitoes for a fixed amount of time and the number of bites counted (YUCK!). To compare the efficacies of two different repellants, volunteers are randomly divided into two groups. One group is given repellant 1 and the other repellant 2 and the test described above is conducted for each.

How could blocking be used to improve the design?
Test Your Understanding 11

In order to identify risk factors for juvenile criminal behavior, researchers compared a large group of juvenile offenders with a group of their peers who were not offenders. These groups were compared with respect to a large number of factors.

1. What kind of a study is this? Be as specific as you can.

2. Suppose the researchers find a number of factors that are quite different for the two groups. Do you think the researchers can conclude these factors cause juvenile crime? Explain.